

it a little lighter than the water it displaces, and then runs with its horizontal rudders or hydroplanes tilted to hold it down. If its engines should break down under water, it must go to the bottom or to the top.

To withstand the pressure of the water at the depths to which it may venture, the inner hull of the vessel is circular and very heavy and strong. As the outer hull has no air spaces, the pressure is the same within and without. It is therefore made of lighter material and so shaped as to keep the vessel steady when running on the surface.

The steersman may stand on the bridge when the vessel is running on the surface; in the conning-tower, with its thick glass sighting ports, when slightly submerged or when seas are high; or in the central station or operating compartment down in the depths of the craft, viewing the surface only through the periscope, when submerged. There are usually at least two periscopes; this provides against accident and permits steersman and commander to use them at the same time.

The Periscope

The periscope tube, about 6 inches in diameter, stands from 15 to 20 feet above the top of the conning-tower. It can turn in any direction, and is sometimes used to give a wider range of vision when the vessel is on the surface. The little tube itself is inconspicuous enough when the vessel is submerged, but it leaves a very suspicious-looking wake behind it. To run blind and then bob up for a view might mean a collision; so periscopes have been devised with a reduced diameter of 2 or 3 inches at the upper end, and also collapsing periscopes, which can be quickly raised by a hand-lever for a moment's view and then dropped down out of sight. (See Periscope.)

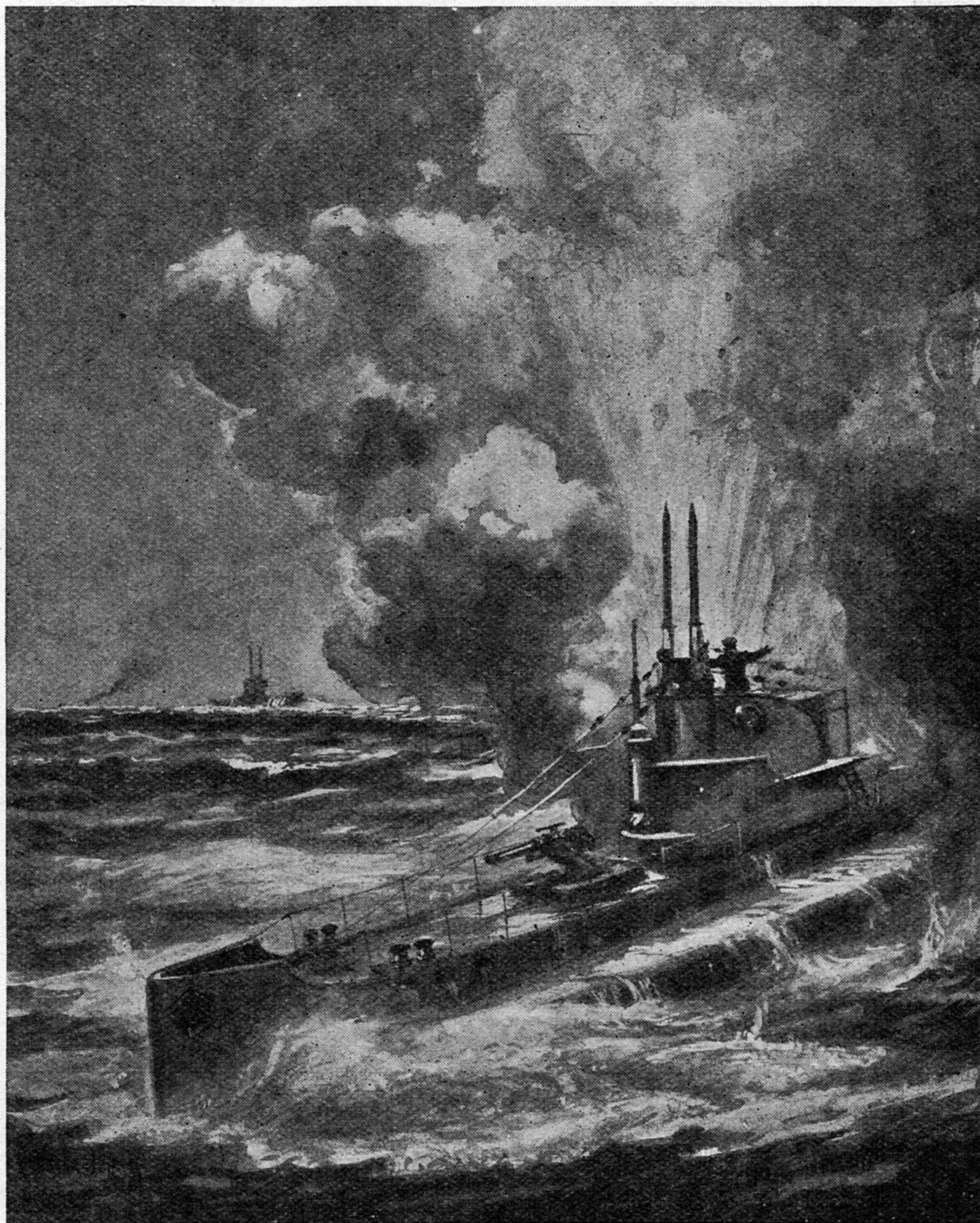
The submarine's guns were at first so mounted as to be depressed on hinges into deck housings when the boat submerged. Later German guns were rigidly mounted and left in place, being coated with grease as a protection against rust,

and covered with a metal casing to decrease propulsion resistance.

How the Torpedoes are Fired

The torpedoes are fired from torpedo tubes by compressed air. Since the discharge of a heavy missile like a torpedo would upset the balance of the boat unless immediately compensated, torpedo-trimming tanks are placed near the torpedo tubes. The early submarines carried two torpedo tubes; later models have four, two in the stern and two in the bow. Some British submarines also carry broadside

DUEL BETWEEN ALLIED SUBMARINE AND U-BOAT



In the World War the most effective weapon against the U-boats was the submarine itself. Such an encounter as this, in which an Allied submarine is bringing a U-boat to bay, was by no means an uncommon occurrence.

torpedo tubes; still others have additional tubes on the superstructure.

Living quarters for three or more officers are ordinarily installed amidships, and folding bunks for 20 to 40 men forward. All this, together with the auxiliary machinery, crowds the little hull almost to bursting. Small men are therefore preferred for submarine duty